



International Journal of Engineering Research and Science & Technology

ISSN : 2319-5991
Vol. 1, No. 2
April 2015



*2nd National Conference on "Recent Advances in Science
Engineering & Technologies" RASET 2015*

Organized by

Department of EEE, Jay Shriram College of Technology, Tirupur, Tamil Nadu, India.



www.ijerst.com

Email: editorijerst@gmail.com or editor@ijerst.com

Research Paper

AN IMPROVED AND EFFICIENT ELECTRIC BICYCLE SYSTEM WITH THE POWER OF REAL-TIME INFORMATION SHARING

I Mydeen Mubarak^{1*}, A Mohamed RajithAli¹, J Asarudeen¹ and P Sivakumar¹

*Corresponding Author: **I Mydeen Mubarak** ✉ mubueee@gmail.com

The aim of this paper is to show that the normal bicycle can be upgraded to electric one by some means- that including the development of a regenerative braking system and innovative BLDC motor control-but also uses real-time sensing and the powers of crowd sourcing to improve the cycling experience; get more people riding bikes; and to aid in the design and development of cities. Technology advances have overcome hurdles of early systems and cities throughout the universe are adopting this model of transportation service. Electric bikes have simultaneously gained popularity in many regions of world some have suggested that it could provide an even higher level of service compared to existing system. There are several challenges that are related electric bike design: electric assisted range ,recharging protocol, and bike and battery checkout procedures. The paper outlines system requirements to successfully develop and deploy an electric bikes, focusing on system architecture , operational concepts, and battery management. Off-line battery management is a promising solution to address this problem. Off-line battery management also support solar recharging and use of dynamo.

Keywords: BLDC motor, Solar recharging, Dynamo

INTRODUCTION

The idea of a motorized bicycle isn't a recent conception and has been around for over a century. Until 1895, electric bicycle created its place in history. That year, Ogden Bolton Was granted U.S patent 552,271 for a powered bicycle with six pole brush-and-commutator DC hub motor mounted within the rear wheel. The bike itself had no gear and therefore before the motor may draw up to 100A with a 10V battery. Since then , the conception of the electric bike became

possible and sensible. Because the years progress, additional and additional electrical bikes were made with varied driving mechanisms. The electrical bicycle offers a cleaner various to travel short-to-moderate distances instead of driving a petrol/diesel-powered automotive. The value of crude has multiplied considerably over the past few years and it looks to be no turning back, the electrical bicycle could be a project which will promote each cleaner technology also as a lesser dependence on oil. It'll run on clean power with

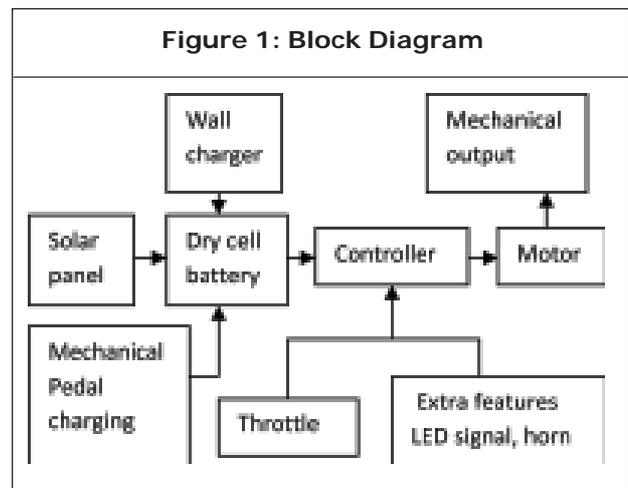
¹ Department of EEE, Jay Shriram group of Institutions, Tirupur

the flexibility to recharge the battery three separate ways: through the 120V AC wall supply, by generating power through the pedals of bicycle dynamo and by solar-cell generative power. Fashionable electrical bicycles integrate many inventions from technology and style, significantly within past year.

DESIGN REQUIREMENTS

There are unit several key elements among the diagram for this method as shown in figure. They encompass a Dry cell battery, motor-controller, photo-voltaic solar array and a brushless DC motor. The ability throttle controller area unit straight forward systems that area unit accustomed trigger the functions for increasing speed, keeping the speed constant, and turning off the motor. The power supply for the systems was a DC battery supply chosen to output 48V. The battery block is interfaced with motor controller block. The motor controller controls all the practical capabilities and is that central part of the system. The fundamental demand for the management is to manage the quantity of power applied to the motor. The management permits the battery to interface with the motor to be bi-face which may provide and receive power. Computer code is given the controller in order that it will regulate the setting and operations for many of the controller’s functions. By making a switch that intentionally is “fooling” the controller to use the motor as a generator while not utterly breaking the wheel, it’s attainable to come up with energy through pedaling. Another supply of battery charging comes from the electrical phenomenon solar array. The solar array with a similar needs of output 12V and twenty watts was found. The ability should be preserved in a very device so, because the voltage in multiplied, the present is

diminished. It’s additional economical to own a better current input to boost device except for the present budget and resources, it’s not sensible. Because of inefficient charging power equipped to the battery, it’s not realistic for solar array to totally charge the battery. Its primary purpose is to supply a extended life cycle for battery associate degree to supply some charge once access to an outlet isn’t accessible.



BRUSHLESS DC MOTOR

Choosing a motor was the primary step in marking associate in nursing applicable system for the electric bicycle. The best resolution in driving the bike is with an electrical DC motor; therefore, making an electric bicycle within the DC motor, a static field flux is evoked mistreatment permanent magnet or a mechanical device coil. For the DC motor to get any torsion , the coils of the coil should be connected to associate in nursing external DC circuit with an excellent range of brush heads. This may cause additional maintenance work to motor. As technology advances ,new and improved styles of the DC motor are enforced. Brushless DC motors square measure the first alternative for a large form of applications. A motor

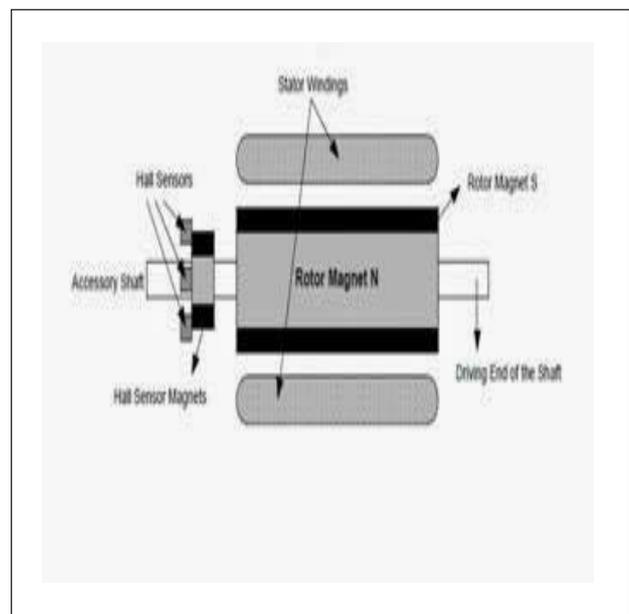
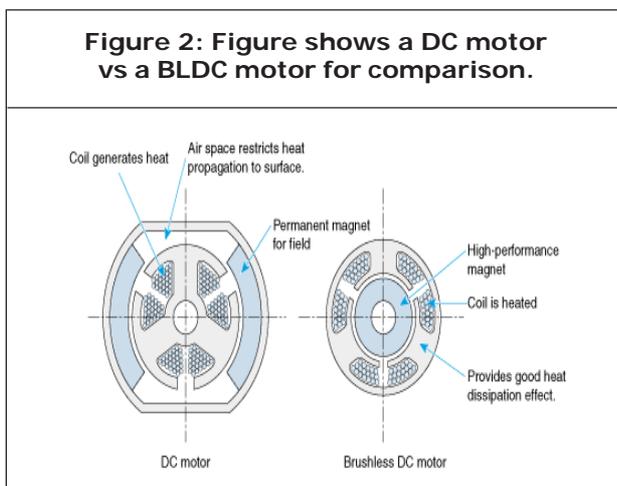
that retains the characteristics of a dc motor however eliminates the electrical switch and also the brushes are termed a Brushless DC motor. They're driven by dc voltage however current commutation is finished by solid state switches i.e., the commutation is finished electronically. BLDC motors square measure offered in many various power ratings, from terribly tiny motors as employed in hard disc drives to giant motors in electrical vehicles.

The BLDC motors have several blessings over brushed DC motors a couple of those are: Higher speed ranges , Higher potency, higher speed versus torsion characteristics, Long in operation life, quiet operation , higher dynamics response etc. All of this contributed to the choice to use a BLDC motor because the driving supply of our electrical bike. The advantages of the BLDC motor offer the electrical bike the responsibility and options it has to create it a sensible and reliable various supply of transportation. Compared to a typical DC motor, the BLDC motor implements an electrical switch rather than a mechanical electrical switch that , in effect ,will increase the responsibility. In order to observe the position of the rotor, sensor square measure usually used, one in every of that is that the hall impact sensing

element that isn't required in standard DC electrical switch motors .

Unlike a brushed DC motor, the commutation of a BLDC motor is controlled electronically. To rotate the BLDC motor, the mechanical device windings ought to be energized in an exceedingly sequence. It's vital to understand the rotor position so as to know that winding are energized following the energizing sequence. Rotor position is detected victimization Hall result sensors embedded into the mechanical devices . Most BLDC motors have 3-Hall sensors embedded into mechanical device on the non-driving finish of the motor. Whenever the rotor magnetic poles pass close to the Hall sensors, they furnish a high or low signal, indicating the N or S pole is passing close to the sensors. Supported the mix of those 3 Hall sensing element signals, the precise sequence of commutation may be determined.

Hall sensors square measure embedded into the stationary a part of the motor. With the combos of the hall sensors, the BLDC provides the foremost economical approach to power and drive a bicycle.





detection signal were transmitted to pins of PIC microcontroller to drive and management the BLDC motor. In PIC16F72 controller has twenty eight pins, 22 I/O pins that are user configurable on pin-to-pin basis. There are thirty five variety of instruction during this PIC controller. Some pins are multiplexed with different device functions.

These perform include:

- External interrupt
- Change on PORT B interrupt
- Timer zero clock/oscillator
- Capture/Compare/PWM
- A/D controller

Electric bicycle options superior PIC16F72 microcontroller core. PIC16F72 has twenty eight pins, embody twenty two 8-bit I/O ports. The PIC16F72 supports PWM for control. CCP1 pin will output the most resolution of 10BIT adjustable PWM signal. AR0~AR4 pins support A/D conversion, they're wont to find dynamic of voltage and current once electrical bicycle is running. As illustrated in Figure 1, speed controlled signal, serving to signal, current detection signal were transmitted to RA1, RA4, RA5 severally. Hall signals from hall detector were transmitted to RC5, RC6. Signals of motor driving were transmitted to RB2 to RB7.

PIC MICROCONTROLLER

Based on PIC16F72, completely different ways are applied electrical bicycle system. The perform of over current protection, beneath voltage protection, power offer, to drive and management the BLDC motor, the utilization of a motor controller was enforced. The different signal like speed controlled signal, current detection signal, brake signal, serving to signal and capability

BATTERY

A Good share of the leading makers supply nickel-cadmium (Ni-CD), nickel-metal binary compound (NiMH), or lithium-ion (Li-Ion) batteries for electrical bicycles. Many makers still supply sealed lead-acid (SLA) batteries. A battery kind should be chosen with utmost care. Shopping for an electrical bicycle and so storing it during a closet or garage for a chronic amount of your time

will have negative result to the life time of the battery. A dry cell could be a form of chemical cells, ordinarily used nowadays, within the kind of batteries, for several electrical appliances. It absolutely was developed in 1887 by Yai-Sakizooof Japan and proprietary in 1892. A Dry cell uses a paste solution, with barely enough wet to permit current flow in a contrast to a voltaic cell, a dry cell will operate in any orientation while not spilling, because it contains no free liquid, creating it appropriate for transportable instrumentality. A regular dry cell contains a metallic element anode, sometimes within the kind of a cylindrical pot, with a carbon cathode within the kind of a central rod. The solution is salt within the kind of a paste next to the metallic element anode. The remaining are between the solution and carbon cathode is concerned by a second paste consisting of salt and atomic number 25oxide, the latter acting as a depolarizer. In some styles, the salt is replaced by metallic element chloride. The battery is rated as 48V, 33AH/20r the most result at associate approximate constant speed of thirty-five Km/hr. The amount of power that employed by our prototyped cycles uses 13.6-13.8V.

DYNAMO

A Generator is associate degree electrical generator that produces electricity with the employment of a switch. Dynamos were the primary electrical generator capable of delivering power for trade, and also the foundation upon that several alternative later electric-power conversion devices were based mostly, together with the electrical motor, the alternating-current generator dominates massive scale power generation, for potency, responsibility and value reasons. A generator has the disadvantages of mechanical

switch. Also, charging alternating to electricity exploitation power rectification devices (vacuum tube or a lot of recently solid state) is effective and frequency economic. The generator uses rotating coils of wire and magnetic fields to convert mechanical rotation into a pulsing direct current through Faraday's law of induction. A generator machine consists of a stationary structure, referred to as the stator coil, that provide a continuing flux, and a group of rotating windings referred to as coil that flip among the field. The motion of the wire within the flux causes the sphere to pass on the electrons within the metal, making an electrical current within wire. On little machines the constant flux is also provided by one or a lot of permanent magnets; larger machines have the constant flux provided by one or a lot electromagnets, that square measure typically referred to as field coils.

Ratings of dynamo used in this project:

Power =12W, Voltage=12V, Current=1A.

P= Number of pole=2

A=Number of armature parallel path=2

$\phi = 0.4$ wb (assumption).

SOLAR CELLS

One way we tend to thought of charging the battery is thru the utilization of a cell. Star cells square measure device that convert the energy of daylight directly into electricity through utilization of the electrical phenomenon result. The electrical phenomenon result involves the creation of a voltage during a material upon exposure to electro-magnetic radiation. Star cells square measure typically electrically connected and encapsula Tedasa module with a sheet of glass on prime to permit lightweight to pass and defend the semiconductor from the weather. To get a

desired peak DC voltage with star cells, add them asynchronous, and to get a desired peak current, you add the star cells in parallel, so as to calculate the quality energy of Associate in Nursing application, kilowatt-hours per day is employed. The final rule of thumb is that average power is up to simple fraction of peak power, in order that every peak kW of solar battery output power corresponds to energy production of 4-8 kilowatt-hours per day. There square measure many various varieties of high potency star cells. Here we've got used crystalline/bulk atomic number 14 kind star cells.

CONCLUSION

The issues related to electrical bicycles is also self-addressed by custom-designed drives that are best over a given operative cycle. These embody town bicycles , hill bicycles, distance bicycle, and speedy bicycles. The results of the studies listed here will function a platform to boost electrical bicycle performance if new drive systems are designed around key parameters which will end in improvement of system performance. Moreover , they will be used for comparison of existing drives during a systematic, comprehensive, and technical

approach. This paper has illustrated the controller that takes PIC16F72 as a core, introduced some vital elements AND circuit principle diagram. The controller has operate of over-current protection, under-voltage protection, serving to so on. Experiment micro-controller has higher dynamic characteristics and ran steady. There are multiple opportunities with this project and that we hope that among some years, bicycle will become terribly economical and marketable. We tend to perceive that this bicycle are often daunting as a result of this weight and its ability to travel forty mph.

REFERENCES

1. Robert Cong, Rodney Martinez, Mark Casilang, *Peter Vong Electric Bicycle System*.
2. Zhidong Zhang, Jingfeng Shen, baohui Li, *Design of Controller in Electric Bicycle*.
3. Vic Roads website. Vic Roads "Power assisted bicycles".
4. Kumar B and Oman H (1993), "Power control for battery-electric bicycles", in proc.NAECON '93 National Aerospace and Electronics Conf., Vol. 1, May 24-28,1993.



International Journal of Engineering Research and Science & Technology

Hyderabad, INDIA. Ph: +91-09441351700, 09059645577

E-mail: editorijerst@gmail.com or editor@ijerst.com

Website: www.ijerst.com

